

## B777 Alerting Issues – In-flight cargo fire/smoke

### 1. Initiating Condition: Ignition of cargo leading to extinguishable belly cargo compartment fire, in cruise

Type	Alert or cue	Threshold for alert or cue to be presented	Confusion regarding alert or cue	Other issues with regard to alert or cue	When alert is inhibited/suppressed or when cue is masked	How alert or cue is terminated
<b>Visual Alerts</b>	Master Warning lights on forward glare shield panel illuminate red	Smoke detected in cargo compartment			Alert can be suppressed by fire damage to the fire detection system; however, the detection system is monitored by EICAS and fault/failure, if sensed, should result in a DET FIRE CARGO FWD or AFT caution message	Fire Warn light is cancelled by pressing Master Warning light
	CARGO FIRE FWD or AFT warning light on the overhead panel illuminates red	Smoke detected in cargo compartment			Alert can be suppressed by fire damage to the fire detection system; however, the detection system is monitored by EICAS and fault/failure, if sensed, should result in a DET FIRE CARGO FWD or AFT caution message	Warning light is extinguished when the fire detection system assesses that the fire has been extinguished; this is expected to continue even after fire is extinguished due to continued presence of smoke in the compartment
	EICAS warning message "FIRE CARGO FWD or AFT"	Smoke detected in cargo compartment			Alert can be suppressed by fire damage to the fire detection system; however, the detection system is monitored by EICAS and fault/failure, if sensed, should result in a DET FIRE CARGO FWD or AFT caution message	EICAS warning message is extinguished when the fire detection system assesses that the fire has been extinguished; this is expected to continue even after fire is extinguished due to continued presence of smoke in the compartment
<b>Aural Alerts</b>	Fire Bell	Smoke detected in cargo compartment			Alert can be suppressed by fire damage to the fire detection system; however, the detection system is monitored by EICAS and fault/failure, if sensed, should result in a DET FIRE CARGO FWD or AFT caution message	Fire Bell is cancelled by pressing Master Warning light
<b>Tactile Alerts</b>	None					
<b>Visual Cues</b>	None					

## B777 Alerting Issues – In-flight cargo fire/smoke

### 1. Initiating Condition: Ignition of cargo leading to extinguishable belly cargo compartment fire, in cruise – Cont.

Type	Alert or cue	Threshold for alert or cue to be presented	Confusion regarding alert or cue	Other issues with regard to alert or cue	When alert is inhibited/suppressed or when cue is masked	How alert or cue is terminated
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<b>Aural Cues</b>	Possible reports from flight attendants or cargo supernumeraries about hot floor surfaces, presence of smoke or fumes, other evidence of fire/overheat	(No specific threshold; depends on flight attendants' inquisitiveness, persistence, communications abilities, as well as pilots' skills in prompting flight attendant investigation/communication)				
<b>Tactile/Somatic Cues</b>	None					

#### Expected Pilot Response(s)

- Perform the FIRE CARGO FWD or AFT non-normal procedure.
- As part of the procedure, have cabin crew evaluate appropriate cabin areas for hot floor surfaces, presence of smoke/fumes, and other evidence of fire/overheat.
- As part of the procedure, suppress execution of the LANDING ALTITUDE (and EQUIP COOLING OVERRIDE if forward cargo fire) NNPs despite the display of EICAS caution messages for these during execution of the cargo fire procedure.
- Land within the required time limit
- After landing, have cabin crew re-assess conditions and advise ground personnel not to open cargo compartments without prior clearance from ARFF.

#### Possible sources of confusion with regard to pilot response(s)

- History of false fire/smoke detector alarms can cause pilots to downplay or discount a valid warning.
- Difficult/impossible to distinguish with certainty an active fire from minor or leftover smoke, or from a false alarm caused by dust or other triggers.
- Even once the pilots know that a fire situation is ongoing, they do not necessarily know the seriousness of the situation, the future course of the fire, or the time available for continued safe flight. Consequently, they will have difficulty projecting the best course of action and the time available for implementing it.

## **B777 Alerting Issues – In-flight cargo fire/smoke**

1. Initiating Condition: Ignition of cargo leading to extinguishable belly cargo compartment fire, in cruise – Cont.

### **How does pilot know condition is resolved/recovered?**

- Previously illuminated CARGO FIRE Fwd or Aft light on overhead panel is extinguished.
- Fire damage to fire/smoke detection system can cause pilots to mistakenly believe that a fire has been extinguished when it actually continues to burn, although the detection system's self-testing function helps to identify this situation.
- Situation is not fully resolved until the aircraft has been returned to the ground and the ARFF response has been applied to the involved compartment and (if necessary) the aircraft has been evacuated.

### **Issues with regard to multiple concurrent non-normal conditions**

- Warnings/alerts/cues of other system failures (e.g., electrical, pneumatic, hydraulic) may be presented if these systems or associated detectors receive fire damage; these indications may distract the pilots' attention from responding to the primary fire situation or mask the primary situation.
- On the other hand, these secondary failures may require additional responses by the pilots, and the optimal prioritization of pilot response to these multiple cues may be unclear.

## B777 Alerting Issues – In-flight cargo fire/smoke

### 2. Initiating Condition: Dust/moisture leading to false indication of smoke in a cargo compartment, in cruise

Type	Alert or cue	Threshold for alert or cue to be presented	Confusion regarding alert or cue	Other issues with regard to alert or cue	When alert is inhibited/suppressed or when cue is masked	How alert or cue is terminated
<b>Visual Alerts</b>	Master Warning lights on forward glare shield panel illuminate red	Smoke falsely detected in cargo compartment	False alarm (no actual fire or smoke) will present the same alerts as an actual fire			Master Warning lights are cancelled by pressing either light
	CARGO FIRE FWD or AFT warning light on the overhead panel illuminates red	Smoke falsely detected in cargo compartment	False alarm (no actual fire or smoke) will present the same alerts as an actual fire			Illuminated light on fire panel is extinguished when the fire detection system assesses that the fire has been extinguished
	EICAS warning message "FIRE CARGO FWD or AFT"	Smoke falsely detected in cargo compartment	False alarm (no actual fire or smoke) will present the same alerts as an actual fire			EICAS message is extinguished when the fire detection system assesses that the fire has been extinguished.
<b>Aural Alerts</b>	Fire Bell	Smoke falsely detected in cargo compartment	False alarm (no actual fire or smoke) will present the same alerts as an actual fire			Fire Bell is cancelled by pressing a Master Warning light
<b>Tactile Alerts</b>	None					
<b>Visual Cues</b>	None					

## B777 Alerting Issues – In-flight cargo fire/smoke

2. Initiating Condition: Dust/moisture leading to false indication of smoke in a cargo compartment, in cruise – Cont.

Type	Alert or cue	Threshold for alert or cue to be presented	Confusion regarding alert or cue	Other issues with regard to alert or cue	When alert is inhibited/ suppressed or when cue is masked	How alert or cue is terminated
<b>Aural Cues</b>	Some indication that alarm is false, though extremely ambiguous, from negative reports from flight attendants or cargo supernumeraries about hot floor surfaces, presence of smoke or fumes, other evidence of fire/overheat	(No specific threshold; depends on flight attendants' inquisitiveness, persistence, communications abilities, as well as pilots' skills in prompting flight attendant investigation/communication)				
<b>Tactile/ Somatic Cues</b>	None					

### Expected Pilot Response(s)

- If the fire warning can be ascertained to be false, refrain from performing the cargo fire procedure; otherwise perform the procedure.
- If the fire warning terminates after performing the procedure and can be ascertained to have been false, continue the flight; otherwise land within the specified time limit.
- Unless the fire warning can be ascertained to be false, if the fire warning system indicates that the fire has **\*\*not\*\*** been extinguished after performing the procedure, land immediately.
- Unless the fire warning can be ascertained to be false, advise ground personnel not to open cargo compartments without prior clearance from ARFF.

### Possible sources of confusion with regard to pilot response(s)

- Difficult/impossible to distinguish with certainty an active fire from minor or leftover smoke, or from a false alarm caused by dust or other triggers.
- As pilots consider that a fire situation is ongoing (despite the fact that it is not), they also have difficulty projecting the best course of action and the time available for implementing it.

### How does pilot know condition is resolved/recovered?

- Previously illuminated Fwd or Aft light on cargo fire panel is extinguished.
- Situation is not fully resolved until the aircraft has been returned to the ground and the ARFF response has been applied to the involved compartment, assessing and communicating to the pilots that the fire warning was false.